Description of Courses: Bachelor of Industrial Engineering

Courses Type: Basic			**Number of Courses: 9** **Number of Credits: 22**
Course Title	**Credits**	**Hours**	**Course Description**
Physics I Lab. **Prerequisite:** Physics I	1	34	Practical Experiments Related to "Physics I" Course.
Physics II Lab. **Prerequisite:** Physics II	1	34	Practical Experiments Related to "Physics II" Course.
Computer Programming **Prerequisite:** General Mathematics I	3	51	Introducing organization and main parts of computer, machine language and assembly, numeric and non-numeric data representation, algorithms and sub-algorithms and flowchart, basic concepts such as frequency, familiarity with Pascal Programming language: constants and variables, computational and logical phrases, different types of instructions, different types of conditional operations loops, vectors and matrices, subprograms, input and output instructions, common algorithms such as methods of search and arrangement, practical examples of programming.

Calculus I	3	51	Cartesian coordinates; polar coordinates; complex numbers; addition, product, root & geometrical representation of complex numbers; polar representation of complex numbers; function; functions algebra; limit and relevant theorems; infinite limit and limit in infinite; left-hand and right-hand limit; connectivity; derivative; derivation formula; inverse function and its derivative; trigonometric functions derivative and their inverse functions; Rolle's theorem; mean theorem; Taylor expansion; geometrical and physical applications of derivative; curves and acceleration in polar coordinates; application of derivative in approximation of equations roots; definition of integral of continuous functions and piecewise continuous; basic theorems of differential & integral arithmetic; primitive function; approximate methods of integral estimate; application of integral in computation of area, volume, length of curve, moment, center of gravity and labor (in Cartesian and polar coordinates); logarithm and exponential function and their derivative; hyperbolic functions; integration methods such as change of variable, component and decomposition of fractions; transform of special variables of sequence and numerical series and relevant theorems. power series and Taylor theorem and recursive functions.
Calculus II **Prerequisite:** Calculus I	3	51	Analytic Geometry in Euclidean Plane and Euclidean Space, Vector-Valued Functions, Elementary Theory of Curves and Surfaces, Ferenet-Serret Apparatus, Multivariable Functions (Limit and Continuity, Partial Derivative), Polar, Spherical and Cylindrical Coordinates, Multiple Integration, Green and Stokes Theorems, Elementary Account of Differential Forms.
Physics I **Prerequisite:** Calculus I	3	51	Measurement, Motion in two and three dimensions, forces and Newton's laws and its application, momentum, systems of particles, rotational kinetics, rotational dynamics, angular momentum, work and kinetic energy, potential energy, conservation of energy, gravitation, Temperature, molecular properties of gasses, first law of thermodynamics, entropy and second law of thermodynamics.

Physics II **Prerequisite:** Physics I	3	51	Electric charge and Coulomb's law, the electric field, Gauss' law, Electric Potential Energy and Potential, the electric properties of materials, Capacitance and Capacitors, DC Circuits, the magnetic field and magnetic field of a current, Faraday's law in induction, magnetic properties of materials, inductance, AC circuits, Ampere's law.
Numerical Methods **Prerequisite:** Computer Programming	2	34	Approximations and errors, instability in numerical computations and methods of their prevention. Curve fitting and interpolation: interpolating criteria, least-squares regression, Lagrange interpolating polynomial with one and two variables. Cubic spline interpolation. Newton interpolating polynomial. Taylor approximation. Liner and polynomial regressions. Other common regression curves. Chebyshev approximation (minimax polynomial); Numerical differentiation and integration: Numerical integration by trapezoidal rules and Simpson rules. Gauss-Legendre, Gauss-Chebyshev and Gauss-Hermite quadratures. Romberg method and Richardson extrapolation. Numerical differentiation; Roots of algebraic and transcendent equations: bisection method, substitution method, Newton methods for real and complex variables; Systems of linear algebraic equations: Direct methods (Gauss elimination and LU decomposition). Iterative methods (Jacobi method and Gauss-Seidel method); Solving methods for nonlinear systems: Jacobi method, generalized Newton method, Newton-Rephson method; Mathematical modeling of engineering problems: physical system, classification of problems, system analysis (topological modeling, systems with consented parameters and types of equations, systems with distributed parameters and types of equations); Integration of first-order Ordinary Differential Equation(ODE) with initial condition using Runge-Kutta methods of 1st to 4th order. Predictor-corrector methods. Runge-Kutta methods for first order ODE systems. Finite difference method for ODE with boundary conditions; Numerical solving of elliptic equations, and parabolic equations.

Differential Equations **Prerequisite:** General Mathematics II	3	51	Nature of differential equations and their solution, family of graphs and vertical routes, physical patterns, separable equation, first order linear differential equation, homogeneous equation, second order linear equation, homogenous equation with fixed constants, method of indefinite constants, method of changing parameters, application of second order equations in physics and mechanics, solution of differential equation with series, Bessel and Gamma functions, Legendre polynomial, an introduction to differential equations set, Laplace transform and its application in solving differential equations.

Courses Type: Major			Number of Courses: 23 Number of Credits: 63
Course Title	**Credits**	**Hours**	**Course Description**
Electrical Engineering Fundamentals Lab. **Prerequisite:** Principles of Electrical Engineering	1	34	Introduction. Special Probability Distributions. Special Probability Densities. Functions of Random Variables. Sampling Distributions. Decision Theory. Point Estimation. Interval Estimation. Hypothesis Testing. Tests of Hypotheses Involving Means, Variances, and Proportions. Regression and Correlation. Analysis of variance. Design and Analysis of Experiments.
Simulation **Prerequisite:** Computer programming + engineering statistics			Define and cases of usage in planning, Species of simulation systems – generating random number with uniform distribution including continuous and discrete and their applications in simulation problem, statistical analysis in simulation, introduce simulation language, survey DOE topic in simulation, survey factors related to output accuracy obtained of simulation, survey optimization in simulation, Build basic simulation models in ARENA
Management Principles & Organization Theory **Prerequisite:** Motion & Time Study	2	34	Introduction to management principles, managers and management: history module and the historical roots of contemporary management, the management environment. PLANNING: foundations of planning, foundations of decision making, quantitative module quantitative decision-making aids. ORGANIZING: basic organization designs, staffing and human resource management, career module building a career, managing change, stress and innovation. LEADING: foundations of individual and group behavior, understanding work teams, motivating and rewarding employees, leadership and trust, communication and interpersonal skills. CONTROLLING: foundations of control, operations management.

Engineering Statistics **Prerequisite:** Probability Theory & Its Application	3	51	Introduction. Special Probability Distributions. Special Probability Densities. Functions of Random Variables. Sampling Distributions. Decision Theory. Point Estimation. Interval Estimation. Hypothesis Testing. Tests of Hypotheses Involving Means, Variances, and Proportions. Regression and Correlation. Analysis of variance. Design and Analysis of Experiments.
Motion & Time Study **Prerequisite:** Manufacturing processes I , Probability Theory & Its Application	3	51	Productivity, work study, registration of events, OPC, FPC, flow diagrams, economic movement principals, Therblings, work measurement, time measurement, work sampling, structured standard data, analytical and comparative estimating, quantitative techniques for human, machine relations, linear production techniques, line balancing.
Statistic & Solid mechanics **Prerequisite:** Calculus I + physics I			Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.
Accounting & Cost Finding Principles	3	51	An overview of the financial accounts and introduction to asset items, liabilities, capital, income and expenses, investment accounts, purchasing and payments, and depreciation, profit and loss account, the balance sheet, calculating final Cost of goods produced in an institutions, billing cash flow, costs classification, methods of inventory pricing in warehouses, FIFO and LIFO methods , fixed assets and machinery depreciation calculation methods, Application of cost accounting in assessment and control of operations.

General Economics I	2	34	Introduction to microeconomics, production factors, Basic economic issues (usage degree of available resources, selecting the type and amount of goods and services, methods of production and distribution of goods and services, determination of performance or efficiency of production and distribution, economic growth), production possibility curve, definition of demand, demand curve, Factors that affect demand, demand sensitivity, definition of supply, supply curve, factors that affect supply, changes in supply, supply sensitivity, balance between supply and demand and price, demand forecasting, (correlation analysis, regression analysis, time series analysis), production theory (production function, production steps), costs (fixed costs, variable costs, total cost, average cost), Income (total income, average income, final income), breakeven point analysis, determination of price and production levels in various markets.
General Economics II **Prerequisite:** General Economics I	2	34	Introduction to macroeconomics , Static and dynamic economic analysis, Definition of national income, GNP,GDP, production and income, the difference between income and capital, measuring national income, national income to price factors, value added, national income to fixed price). balance and imbalance in economic development, mechanisms of economic prosperity, mechanisms of recession and crisis, recent economic crises, definition of inflation, types and causes of inflation and its solution methods. Paasche index, Laspeyres formula,Price indices: PPI, CPI.
Engineering Economics **Prerequisite:** General Economics I	3	51	Decision Making process and definitions related to the engineering economy and alternatives, balanced benefit formulas, alternatives comparison methods: annual costs, Present value, calculation of interest rates, Benefit-Cost ratio, relations between engineering economy and depreciation, minimum attractive rate of return, multiple alternative comparison,(NPW, NEUA, ROR, B/C), sensitivity analysis in engineering economy, engineering economy under uncertainty.

Production Planning **Prerequisite:** Operations Research I , Production Planning & Inventory Control I , Project Control.	3	51	Definitions, concepts, importance and the role of production planning in manufacturing processes, Introduction to MRP and MRP II, types of production planning, heuristic methods. Strategic planning and Long-term planning, medium-term planning, and short-term Planning. Manufacturing Process: series of operations that should be performed in order to raw materials convert to finished goods; Such as the layout process, machine and labor operations sequence. Static production planning models, the application of linear programming in production planning, determining the best production process, capacity requirement planning (CRP), determining the economic level for a production machine, Dynamic production planning models: production models with linear cost, dynamic programming models, Line Balancing: balancing the manufacturing resources, heuristic methods and mathematical models, multi-product models, multi-stage production models. Probabilistic models, Production planning with probabilistic and fixed demand for multiple production periods. Operations Planning: Sequencing and Scheduling Systems, workshop planning for N work on one machine. N work on two machines, n work on Three machines, N work on M machines, line production balance: heuristic methods and mathematical models, point to application of project planning in production planning
Production Planning & Inventory Control I **Prerequisite:** Operations Research I , Probability Theory & Its Application	3	51	Introduction to Supply chain management, Schedule(MPS), Procedure for developing MPS, MRP terminology, process of MRP, Lot sizing in MRP, types of production systems, Inventory and production planning and control, types of inventory costs, types of order systems, FOS and FOI systems, ABC analysis, Economic order Quantity, Wilson's formula, sensitivity analysis, Inventory models, safety stock calculations, probabilistic inventory models, with variable lead time, variable demand, and variable cost. Multi-product inventory models. Need for Forecasting, Factors affecting Demand, Demand Patterns, Qualitative, Forecasting methods: Regression, weighted moving average, Exponential smoothing with adjusted trend, types of trends. Compression indices for forecasting methods: Cumulative

			forecast error, average forecast error, mean square error, mean absolute error, mean absolute percent error. Objectives and Activities of Production Activity Control, Flow-shop and Job shop, production activity control.
Probability Theory & Its Application **Prerequisite:** General Mathematics II	3	51	Combinatorial Analysis, Axioms of Probability, Conditional Probability and Independence, Bayes' Formula, Random Variables, Continuous Random Variables, Jointly Distributed Random Variables, Mathematical Expectation, Properties of Expectation, Limit Theorems.
Operations Research I **Prerequisite:** Probability Theory & Its Application	3	51	Operations Research Models, Modeling with Linear Programming, Graphical LP Solution, The Simplex Method and Sensitivity Analysis, determination of basic feasible solution and utilization of artificial variable for formulation of linear programming problem, M-Method, Two-Phase Method, Degeneracy, Algebraic Sensitivity Analysis, Changes in the Right-Hand Side and Objective Function, Duality and Post-Optimal Analysis, Economic Interpretation of Duality, Transportation Models and Its Variants, The Assignment Models, Hungarian Method, Transshipment Model, Revised Simplex Method, Parametric Linear Programming.Introduction to LINGO and WinQSB packages.
Operations Research II	3	51	Network Models terminology, formulation and optimal solution method using network simplex (sho rtest path, minimum spanning tree, maximum flow and minimum cost flow), dynamic programming: basic concept and solution, examples of problem solved using dynamic programming, Minimal Spanning Tree Algorithm, Shortest-Route Problem, Goal Programming Algorithms, Integer Linear Programming,

Prerequisite: Operations Research I			Set-Covering Problem, Branch-and-Bound (B&B) Algorithm, Cutting-Plane Algorithm, Deterministic Dynamic Programming, Forward and Backward Recursion, Decision Analysis, Decision Making under Certainty, Risk, and Uncertainty, Analytic Hierarchy Process (AHP), Game Theory, Queuing Systems, Poisson Queuing Model, Multiple-Server Models, Machine Servicing Model— (M/M/R):(GD/K/K). (M/G/1):(GD/∞/ ∞)—Pollaczek-Khintchine (P,K) Formula, Unconstrained and constrained Nonlinear Programming Algorithms, Quadratic Programming.
Linear Algebra **Prerequisite:** Calculus I			Matrix algebra, Systems of linear equations, Eigen values and Eigen vectors , Systems of linear equations and matrices. Vector spaces and linear transformation using matrix notation, determinants
Manufacturing Processes **Prerequisite:** Material science + Machine Tools Workshop **I**			Product design and process selection cast molded products, sand casting. Plaster mold casting. Shell-molding. Investment casting. permanent mold casting. Centrifugal casting. Slush casting. Continuous casting. Shot casting. Drilling. Milling. Shaping. Planning. Broaching. Turning. Boring. Sawing. Grinding. Abrasive machining. Abrasive jet machining. Numerical control and automated processes. Chemical milling. Electro-discharge machining. Electro-chemical machining. Laser beam machining. Ultrasonic machining. Electron beam machining. Forging. Powder metallurgy. Press working. Cutting(plate, sheet and strip). Conventional bending and forming processes. Extrusion. Cold forming processes. Drawing. Deep drawing. Electroforming. Electroplating. Electromagnetic forming. Explosive forming. Surface finish and micro finishing. Finishing processes. Surface cleaning processes. Protective coatings welding technology, plastics materials and processes. Mannesmann process for seamless tubing tics materials and processes. Mannesmann process for seamless tubing production. Heat treatment(quenching, annealing, normalizing, tempering, softening, hardening)

Plant Layout **Prerequisite:** Manufacturing processes I , Motion & Time Study , Industrial Design I	3	51	Introduction to Plant Layout definitions, Steps of layout planning, S.L.P Algorithm. types of production technologies : fix product layout, product layout, process layout, group layout, job shop, and continuous layout, FMS, machine and device and human resource requirement calculations, materials flow, Simple Assembly Line Balancing, computer algorithms for layout planning CRAFT,COFAD,ALDEP,CORELAP,PLANET, service industries layout planning, nonproductive units planning, warehouse layout planning, Material Handling systems and transportations systems, quantitative location allocation models, Spiral techniques, Traveled Charting, Relationship Diagram, flexible layout models, Contour Lines.
Materials Science			The aims of the course is to give fundamental knowledge about type of materials, their usage, properties and characteristics, which are important in engineering design. It is also aimed to give a theoretical background about the analysis of behavior of engineering materials by emphasizing important relationships between internal structure and properties. It attempts to present ways of modifying and control the material microstructures and especially mechanical properties (toughness, strength, fatigue and creep resistance) by suitable heat treatment operation. **Topics covered:** 1- Introduction to materials 2- Atomic structure 3- Atomic arrangement 4- Imperfections in atomic arrangement 5- Atom movement in materials 6- Mechanical testing and properties 7- Heat treatment of metals and alloy 8- Physical properties of engineering materials 9- Engineering materials 10- Protection against corrosion

Statistical Quality Control **Prerequisite:** Manufacturing processes I , Engineering Statistics	3	51	Introduction to significance of quality in business; quality policy and its objectives , economic aspects of quality, Statistical interpretation, $\bar{X}$,R and S charts, Interpretation of charts, warning and modified control limits, Role of Statistical Quality Control (SQC) in Total Quality Management (TQM) and Six Sigma; SQC tools and techniques, Methods of Statistical Process Control and Capability Analysis, Control Charts for Variables and Attributes, Process and Measurement System Capability Analysis, Sum and Exponentially Weighted Moving Average Control Charts, Multivariate Process Monitoring and Control, Engineering Process Control and SPC tools, Acceptance Sampling, OC curve, AOQL, LTPD, Dodge-Rooming Sampling Plans. Lot-by-Lot Acceptance Sampling for Attributes, Design of Experiments (DOE). Destructive Testing methods.
Electrical Engineering Fundamentals **Prerequisite:** Physics II	3	51	Production and transmission and distribution of power, industrial power distribution, three-phase power, magnetism and magnetic circuits, magnetic force calculations, the core losses in magnetic circuits, DC electric machines, DC Generators, DC Motors. Principles of work and types of permanent flow generator, permanent flow generating characteristics, principles and types of permanent flow engines work .synchronized permanent flow engines. Construction of the alternating current generators (alternator), synchronous induction motors, asynchronous induction motors, single phase and three phase motors.
Project Control **Prerequisite:** Operations Research I	3	51	Definitions of Project and Control, Initial Schedule Plan, Work Breakdown Structure, types of WBS, CPM, predecessors, network techniques, Gantt chart, Allocation of resources, project progress Measurement, S-Curve, probabilistic methods of Project Planning and Controlling (PERT, GERT). Max Flow—Min Cut method.

engineering Graphics I	2	34	Introduction to origin of industrial drafting and its application; definition of projection; drawing of projection, point, line, plane; substance on a projection plane; introduction of main pages of projection; three projections drawing principles; geometrical relation between different projections; drafting tools and their application; standard dimensions of drafting papers; different types of lines and their application; table of map specifications; geometrical drawings; different methods and introduction of first and third order of dihedron; method of drawing three images of a substance in third order of dihedron; method of drawing six images of a substance in first order of dihedron; dihedron transform; drawing image of a substance through its determined images using method of identification of surfaces and volumes; definition of shear, simple shear; broken shear; slant and radial broken shear; broken semi-shear; local shear; circulation and transformed shears; exceptional in shear; definition of concrete projection and its application; normal concrete projection (isometric, diametric, trimetric); bolt and nut junctions; rivet, welding and method of drawing of their different types; method of drawing of modulated maps in brief.

Courses Type: Optional			**Number of Courses: 23** **Number of Credits: 28**
Course Title	**Credits**	**Hours**	**Course Description**
Quality control & Metrology Lab **Prerequisite:**			Lab experiments involving: Measurements of position, displacement, velocity, force, temperature, proximity/range. Measurements of various product features using mechanical, pneumatic, optical and electronic instruments, interferometer, surface roughness

manufacturing process + Statistical quality control			measurements, measurements of threads and gears. Laboratory experiments and exercises involving
Industrial Automation **Prerequisite:** manufacturing process + numerical methods			basic model of automation system, industrial electric diagram, logic gate and electronic circuit, industrial control equipment, theory and basic of control system, data communication and local area network in a manufacturing system, programmable logic controller, numerical, programming and control, hard and soft automation. Different Controllers Employed In Automated Systems Practical Programmable Logic Controller Applications Fundamentals of Programming Including • Programming • Coils • Contacts • Timers and Counters • Logical Program Development basic automation elements, hardware components for Automation and Process Control, the latch principle, Industrial Automation synthesis, logical design for automation, electro pneumatic automation, industrial networks, basic programming in PLC and the PID at the industry.
Marketing			marketing concepts and necessity , market concepts, types of market, market environment, segmenting market, marketing functions and roles, marketing tactics, marketing planning, survey and predict of purchaser behavior, market promotion, market management include product mixture, type and Packaging, issue related to new product, product pricing, role of propaganda in sale promotion, market conservation and expansion, scientific methods in market research
Industrial safety & Hygiene **Prerequisite:**			History and development of safety, laws on occupational health and safety, the administration of safety, inspection and control, remove and control the risks at work, recording accidents at work, investigate the causes of accidents and related costs, accident insurance, education, expanding and motivating for safety in factories, safety in office

			environments, safety in industrial environments, planning for emergencies, personal protection equipment, public health issues, Health services, Safety of non-working people in environment, support organizations of immune systems, electrical hazards, explosive & ignition liquid, fire prevention.
Transportation Planning **Prerequisite:** Operation research I			Introduction, Transportation planning process, Problem definition, Setting objectives, Factors influencing travel demand, Travel demand modeling - Trip generation, Modal split, Trip distribution and Route assignment analyses, Transportation surveys, Land-use models, Travel demand forecasting, Urban structure and its influence of travel intensity, Urban goods movement. **Urban Transportation System Planning:** Transport Planning Process, Problem Definition, Solution Generation, Solution Analysis, Evaluation and Choice, Implementation, Sequence of Activities Involved in Transport analysis. **Trip Generation Analysis:** Trip Production Analysis, Category Analysis, Trip Attraction Modeling. **Mode Choice Modeling:** Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model, Logit Model of Mode Choice, Binary Choice Situations, Multinomial Logit Model, Model calibration, Case studies. **Trip Distribution Analysis:** Presentation of Trip-Distribution Data, PA Matrix to OD Matrix, Basis of Trip Distribution, Gravity Model of Trip Distribution, Calibration of Gravity Model, Singly and Doubly Constrained Gravity Models, A case Studies, Growth Factor Methods of Trip Distribution, Uniform Factor Method, Average Factor Method, Fratar Growth-Factor Method, Disadvantage of Growth Factor Method. **Route Assignment:** Description of transport network, Route Choice Behavior, The Minimum Path, Minimum Path Algorithm, Route Assignment Techniques, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-

			Restrained Traffic Assignment **Transportation Surveys:** Definition of Study Area, Zoning, Types of Movements, Types of Surveys, Home-Interview Survey, Commercial Vehicle Survey, Intermediate Public Transport Survey, Public Transport Survey, Roadside-Interview Survey, Cordon-Line Survey, Post-Card Questionnaire Survey, Registration-Number Survey, Tag-on-Vehicle Survey. **Transport Related Land-Use Models:** Development of Land - Use models, The Lowry Model, Application of Lowry Model. **Urban Structure:** Urban Activity Systems, Urban Movement Hierarchies, Types of Urban Structure, Centripetal-Type Urban Structure, Grid-Type Urban Structure, Linear-Type Urban Structure, Directional Grid Urban Structure. **Urban Goods Movement:** Classification of Urban Goods Movements, Methodology of Approach to Analysis of Goods Movement, Modeling Demand for Urban Goods Transport
Maintenance Planning **Prerequisite:** Probability Theory & Its Application , Engineering Economics	3	51	Introduction and definition of maintenance planning and control maintenance plans, failure rate, van curve, maintenance control, lubrication and general maintenance planning, analysis of failure rates of machines, preventive maintenance, emergency maintenance, maintenance costs, work sampling and control systems, maintenance management, training and education of manpower, implementation and Setup, budgeting allocation, parts replacement models, replacement decision, group replacement, reliability models and management. Maintenance policies: PM, CM, DOM, OM, Condition monitoring. Probability models in maintenance, Choice between PM and b/d maintenance, Optimal PM schedule and quality loss, Inspection decisions: Maximization of profit, Minimization of downtime, Analysis of downtime, Repair time distribution: exponential, lognormal, System

			repair time, Maintainability prediction, Corrective maintenance downtime, Design for maintainability.
Production Planning & Inventory Control II **Prerequisite:** Production Planning & Inventory Control I	3	51	Introduction to types of BOM and part list. aggregate inventory investment, Lot sizing methods and their application in MRP such as : Least Unit Cost, Least Total Cost, Unit Inventory Cost, Silver and Meal's Heuristic method, Mean Cost Per Period, Wagner and Within's algorithm. fordyce & Webster solution. Multiple Constraint Scheduling, Just in Time Concepts (JIT), Distribution Requirements and Management Issues with DRP, Capacity Planning and Utilization, Master Production Scheduling (MPS), Enterprise Resources Planning (ERP)
Decision Analysis **Prerequisite**: Operations research I			The study covers problem analysis, problem solving and decision making method, decision making meaning, decision problem, basic theory and methods on individual or group decision making, Decision Trees and influence Diagrams, sensitivity analysis, the information role on decision making, utility concept, preference, group decision making, Borda method, Delphi, NGT, AHP, Game Theory, Multi Criteria Decision Making
System Analysis **Prerequisite:** Differential Equations			I. Introduction : Information system components, Types on information systems, System development life cycles, The systems analyst II. Systems planning: Systems requests, Objectives Preliminary investigation CTS, III. Determining requirements: Interviews, Other fact-finding techniques, Recording facts, JAD and RAD, Object-oriented systems development, IV. Analyzing requirements: Data flow diagrams: Data dictionary, Process description, Evaluating alternatives, Software alternatives, Evaluating software packages, Hardware alternatives, CASE tools, Systems design, Output design, Input design, File and database design ,System architecture VII. Systems implementation: Quality assurance, Application development, Documentation, Management approval, Installation, Evaluation, System operation

Management Information Systems Design **Prerequisite:** Operations research I	3	51	Introduction to management information systems (MIS), systematic approach and system parameters. Introduction to classic and organizational approached mythologies such as SSADM, BSP, JSD, Oracle, RUP, Information engineering, Information architecture, and CASE tools. Value of information; information storage and retrieval system – database and data structures; knowledge based systems. integration of computer systems with the aims of the organization
Systems **Prerequisite:** Accounting & Cost Finding Principles			Work force planning, jobs evaluating and classifying, investigating on different systems in salary and wage, methods of employees evaluation, paying systems and encouraging methods, paying systems based on performance and so on. salary determinants, incentive pay systems, merit and seniority payments and wage and salary control systems. job requirements are identified, defined, and valued, responsibilities related to the job, quality of job performance and the results achieved, and overall organizational success and profitability. Establishing Wage and Salary Program: Building a Wage and Salary Program, Auditing and Reviewing Current Wage and Salary Program, Building an Information Base, Job Description Compilation, Determining Organization's Pay Policy Developing Wage and Salary Administration Program, an Inventory of Job Description to use in Job Evaluation Process, Determining the Appropriate Method of Job Evaluation, Building Pay Structure, Creating a Wage and Salary Budget, Job Analysis and Job Description: Analyze Jobs to Determine Pay Rates, Collecting, Documenting and Analyzing Data for Job Analysis, Budgeting and Auditing: Designing a Staff Budget Program, Defining Basic Terms, Implementing a Wage and Salary Budge, Managing Wage & Salary Administration Unit: Determining Role and Size of Compensation within Human Resources Function.

General Chemistry	3	51	Introduction to chemistry science, Dalton's atomic theory, chemical laws, atomic weight, definition of mole, chemical calculations. structure of atom, electrical nature of matter, Rutherford experience, electromagnetic radiation, the origin of quantum theory (classical theory of radiation, atom's photoelectric effect of Bohr, atomic spectra and radiation), quantum mechanics, linear range, hydrogen atom, Quantum numbers (S, M, L, N), atoms with more than one electron, Energy levels, electron configuration, periodic table, radius of the atom, ion energy, electron polls, review of the core of atoms and study of radioactive isotopes. Thermo chemistry principles, self-reaction, free energy and entropy. Gas mode: Laws of gases, kinetic theory of gases. Chemical Bonds: covalence and ionic bonds, length and angle of bonds, multiple bonds, polarity of bonds, Hydrogen bond, resonance phenomenon. Metals bonds, semiconductor, and nonconductor. Liquids and solids and solutions: vaporization, vapor pressure, boiling point, freezing point, solids vapor pressure, filtration, dissolution mechanism. Equilibrium chemical systems, Speed of chemical reactions, Acids and bases and ionic balance, Oxidation and reduction: balancing of reeducation and oxidation reactions, Nernst equation, Galvani's cell, corrosive, chemical cells.
Industrial Feasibility Study Project **Prerequisite:** Plant Layout **,** Principles of Accounting & Cost Finding	3	51	Definition of small and medium industries and their role in the countries developments, preparing a plan containing market study, demand management and forecasting, technical and economical feasibility study, specifying the location of industry and its capacity, design engineering, specifying product manufacturing methods, estimating human resource requirements, layout design, project costing, project financing, forecasting the financial performance, instructions to implementation of project, project plan and control, schedule the project implementation. Introduction to COMFAR package.

Automotive Workshop **Prerequisite:**			module Vehicular at Automotive, tune up engine adjustment, Diesel and Petrol Engines, engine body Alternate Fuel systems, Types of Clutch, gear box (manual and automatic), propeller shafting, differential and types of rear axle, Braking System, Steering System, Suspension system, Electrical system, Safety systems, Engine cooling & lubricating Systems. Engine starting Systems. Contact Point & Electronic Ignition Systems. Carburetors, Diesel Fuel Injection Systems , Gasoline Fuel Injection Systems. Coil-Spring Clutch, Diaphragm – Spring Clutch. Double Disk Clutch. Rear Wheel Drive Line. Front Wheel Drive Line. Differentials, Drive Axles and Four Wheel Drive Line. Front Suspension System. Rear Suspension System.
Machine Tools Workshop II **Prerequisite:** Machine Tools Workshop I	1	34	Practical Experience with machine tools with a more complicated object project than ”Machine Tools Workshop I”.
Numerical Control **Prerequisite:** Numerical methods + Manufacturing process			Basic principles of automation; Hard Automation, Flexible Automation Extending the capabilities of conventional machines through improved devices and manipulators; Transfer Machines for Assembly, Multi spindle Automatics, Basic principles of numerical control; Methods of coding and programming; CNC, DNC and Machining Centres; Manual Programming, Computer Aided (APT) programming; Adaptive control; Economics of numerical control. Introduction to Robotics: Synthesis of elements with movability constraints; classification and specification of robots, Laws of Robotics, Elements of robot anatomy; Hydraulic, pneumatic and electrical manipulators; End-effectors and their design; Robot Controllers with microprocessors or fluidics; Sensors – Tactile and non tactile type; Performance analysis of industrial robots and their manufacturing applications; Economics

			of robotics. Introduction to numerical control components, axes of NC machine tools, open and close loop control, actuation and feedback systems. Point to point, lined and contouring systems. Tooling for NC systems. Steps in NC manufacturing. Machining and turning centers and their features. ATC and APC Industrial robots and their applications for transformational and handling activities. Configuration and motions. Actuars, sensors and end effectors. Features like work envelop, precision of movements, weight carrying capacity. Robot programming languages. Vision systems. Introduction to intelligent robots.
Total Quality Management **Prerequisite:** Statistical Quality Control	2	34	Introduction and Basics : focusing quality on getting business results, management systems, quality evolution, QM goals and core values/principles, using a learning and action log to increase class value back on the job. Leadership, Organizational, and HR Issues : communicating and learning styles, motivational concepts, management theories and styles, organizational structures, team evolution, roles, and making teams effective, Manger's model for analyzing performance problems, training needs analysis, development, delivery, and improvement. Strategic Planning : strategic planning and deployment model, mission, vision, values , SWOT, gap analysis, and benchmarking , long and short-term goals, setting and implementing plans. Customer and Market Focus : market segmentation and customer knowledge , determining and deploying customer needs including QFD, customer survey feedback process, methods to depict survey results graphically, customer relationship enhancement. To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management. various principles, practices of TQM, various statistical approaches for Quality control.TQM tools for continuous process improvement. importance of ISO and Quality systems

			Introduction - Need for quality - Evolution of quality - Definition of quality -Dimensions of manufacturing and service quality - Basic concepts of TQM -Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby –Barriers to TQM. Leadership – Strategic quality planning, Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customerretention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating. The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT –Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.
Financial Management **Prerequisite:** Principles of Accounting & Cost Finding	2	34	Definition of the goal and functions of financial management, review of accounting, financial analysis, financial statement and ratio analysis including solvency, liquidity and profitability, nature of risk, interrelationship between risk and return; effect of tax on return. financial forecasting, operating and financial leverage, working capital and the financial decision, current asset management, sources of short term financing, the time value of money, valuation and rates of return, financial planning, including income statements, balance sheets and cash flow statements.Analysis and interpretation of standard financial statements. Concept of operating cycle and working capital management. Planning of profit and leverage (operating and financial). Project evaluation indices like NPV, IRR. Definition and scope of cost accountancy and costing methods; Elements of cost identifications; Recording, ascertainment of direct material and labor cost; Overhead classification, distribution and absorption; Process costing, uniform, marginal and standard costing methods;

Stochastic Models & Queuing Theory **Prerequisite:** Probability Theory & Its Application			stochastic modeling relevant to problem solving in the area of industrial engineering. The study covers probabilistic theory, random variable and distribution, mathematical modeling and stochastic process, Poisson process, renewal process, discrete Markov chain, continuous Markov chain, Markov renewal process, semi-Markov process, reliability model, maintenance, inventory and supply-chain. Queuing theory terminology – Single server, multi server, Limited queue capacity
Mechanical Assembly **Prerequisite:** Manufacturing processes II	3	51	Presenting a systematic approach to design and assembly of mechanical assemblies. It introduces mechanical and economic models of assemblies and assembly automation at two levels. "Assembly in the small" includes basic engineering models of part mating, and an explanation of the Remote Center Compliance. "Assembly in the large" takes a system view of assembly, including the notion of product architecture, feature-based design, analysis of mechanical constraint, assembly sequence analysis, tolerances, system-level design for assembly and JIT methods, and economics of assembly automation. Class exercises and homework include analyses of real assemblies, the mechanics of part mating, and a project.
Human Factors Engineering **Prerequisite:** Motion & Time Study	3	51	Ergonomics or Human Factors Engineering Concerns the study of human beings and their interaction with products, environments, equipment, and machines in performing tasks and activities, therefore its objectives are to maximize human and system efficiency and productivity and quality of life by Considering the human physiological and psychological factors that underlie the design of equipment. This course covers the materials such as: What are human factors and ergonomics? Research methods, Design & evaluation methods, Vision Perception, Hearing Perception, Cognition & Memory, Displays & Controls, Work-space design, Biomechanics of work, Cumulative trauma disorders, Physical and mental capacity, Stress & workload (physical & mental), Safety & human error. Human-computer interaction.

Courses Type: Workshop			Number of Courses: 5 Number of Credits: 7
Course Title	**Credits**	**Hours**	**Course Description**
Welding & Sheet Forming Workshop	1	34	Safety issues and procedures of welding, different types of welding methods and instruments, and power supplies. Electric arc welding, Creating electric arc, setting the correct electrode gap, and electrode angles, oxidation conditions. Basic weld joints: butt joint, lap joint, corner joint, edge joint, and T-joint. Oxyacetylene welding.
Workshop of Casting, Melting & Modeling	1	34	Objective: familiarize with casting and foundry tools in industry, learning to build various models and their application. by two workshops: 1: Melting Workshop, casting tools and types of sand molding with simple uniform, and non uniform models, the pouring of molten, models with the movable wet sands. Molds with dry sands, multi piece models casting, and pouring molten inside them. 2: Modeling Workshop, Creating a pentagon model, making model (simple cam gears), making cylinder model and place it inside a hollow cylinder, calculations related to shrinkage and slope value.
Machine Tools Workshop I	1	34	An introduction to principles of safety and health in workshops and modality of application of tools and instruments in these workshops. In this course, the student shall learn method of work with workshop tools and equipment in Machine Tools, and Practical Experience with machine tools with a project.

Industrial Training **Prerequisite:** Passing 100 course credits.	1	240	Students have to work in a company or factory in a field related to their interests under the supervision of a faculty member for 180 hours.
project			This course is a means for the student to show his/her ability to integrate all knowledge and skills acquired by designing or improving integrated system. Each student will be assigned any one of the following types of project/thesis work: (a) Industrial case study (b) Preparation of a feasibility report (c) Thesis by experimental research, and (d) Design and development of equipment.